

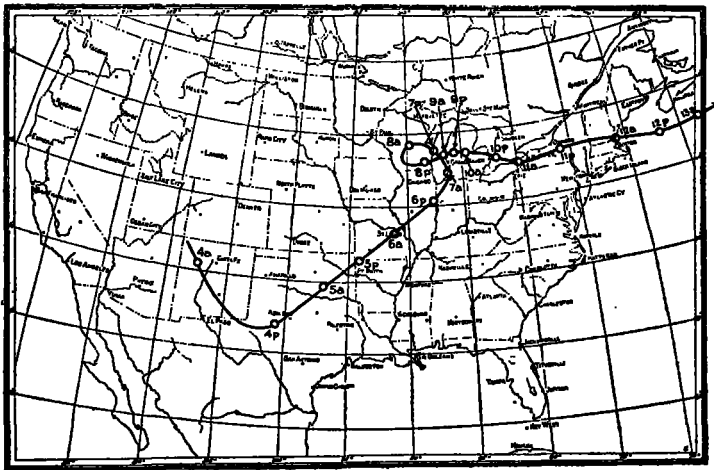
## SECTION III.—FORECASTS.

## FORECASTS AND WARNINGS FOR JUNE, 1916.

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During the month of June, 11 primary disturbances crossed the United States, and of these 5 were of the Alberta type, 4 of the Colorado, 1 of the Texas, and 1 of the North Pacific. HIGHS were 11 in number, and of these 2 were of the South Pacific type, 2 of the North Pacific, 4 of the Alberta, and 3 of the Hudson Bay type. The tracks of the disturbances were without abnormal features except in the case of No. III of the Texas type. This disturbance first appeared on the 4th over New Mexico and was last observed on the 13th south of Nova Scotia. The track of this storm is of particular interest and is also shown on the small chart forming figure 1. This disturbance pursued a normal course until it reached Lake Michigan, there it made a complete loop and then moved directly eastward. At the time of making the loop the disturbance lost intensity very rapidly. The movement of the HIGHS was uniformly toward the east except in the case of the three of the Hudson Bay type. These had a large south component of motion.



Date.	A. M.	P. M.	Date.	A. M.	P. M.
	Inches.	Inches.		Inches.	Inches.
June 4.....	29.50	29.34	June 9.....	29.58	29.72
5.....	29.38	29.28	10.....	29.80	29.84
6.....	29.22	29.32	11.....	29.92	29.96
7.....	29.30	29.18	12.....	29.96	29.94
8.....	29.34	29.46	13.....	29.90	

FIG. 1.—Track and pressures of the storm of June 4-13, 1916.

The pressure over the region of the Hawaiian Islands, as shown by daily reports from Honolulu, averaged normal. Readings were relatively low the first and high the second half of the month, and day to day changes were slight to moderate in magnitude. Over the Alaskan area the average pressure for the month showed deficits of from 0.06 to 0.10 inch, except at Sitka, where the pressure averaged 0.01 inch above the normal. With the exception of the disturbance of the 29th-30th, no general storm of marked character occurred, although two lows of decided intensity showed at Dutch Harbor, one on the 8th, and the other about the 13th. Generally speaking, fluctuations were slight and neither high nor

low pressure persisted for any length of time, there being alternations from low to high and vice versa. Sitka showed the steadiest conditions, having high pressures from the 1st to 16th, and pressures generally below normal thereafter. Over the western Atlantic pressure was slightly above the normal, while over the eastern portion the pressure was below normal. At Horta pressure was below the average during the first two decades and at the last of the month, and high at other times during the last decade. At Bermuda low pressure prevailed from the 2d to 8th, 13th to 15th, on the 22d, and last of the month, pressure being high at other times.

*Washington District.*—Except during the first week of the month, no unusual atmospheric conditions occurred and no general warnings were required. On the 14th warnings of winds dangerous to small craft were issued for the benefit of shipping on the Great Lakes, and on the 19th warnings of frosts in exposed places were issued for northern Michigan. The storms of importance in this district occurred during the first week of the month. The first of these was central over Kansas the morning of the 1st; from that region it advanced northeastward, its center crossing the region of the upper Lakes during the 2d. On the morning of the 2d storm warnings were displayed on the Great Lakes except western Lake Superior and extreme southern Lake Michigan. During the 2d this disturbance was attended by strong shifting winds on the Great Lakes, but as it moved rapidly the storm winds were of short duration, despite the fact that the pressure decreased to nearly 29 inches in upper Michigan. Velocities of 46 miles an hour from the southwest at Toledo and 42 miles an hour from the south at Erie were the highest recorded storm winds at Lake stations; all other maximum velocities did not exceed 38 miles an hour.

The second storm (III on Chart II) and the only other of importance during the month formed over the southern Rocky Mountain region on the 4th and thence moved northeastward. On the morning of the 5th its center (lowest pressure 29.38 inches) was over Oklahoma, the morning of the 6th its center (29.22 inches) was over eastern Missouri, and the morning of the 7th its center (29.28 inches) was over southern Lake Michigan. From this point the center of this disturbance advanced in a westerly course, accompanying the building of an extensive area of high pressure in the St. Lawrence Valley, to Wisconsin, where it remained without appreciable progressive motion but with rapidly diminishing intensity for 48 hours. At the end of this time it advanced slowly eastward and finally was dissipated over the St. Lawrence Valley on the 11th, when the pressure at its center had risen to approximately 30 inches. This storm was one of great violence for the month of June on the Great Lakes, gales of long duration prevailing on Lakes Michigan, Huron, Erie, and Superior, but no serious loss of shipping occurred, unquestionably because of the timeliness of the warnings. The first of these warnings was issued for Lake Michigan on the 5th when the center of the disturbance was over northeastern Oklahoma, and storm winds did not set in on Lake Michigan until the 6th. On the morning of the 6th the display of storm warnings was extended to Lakes Huron and Erie and on the 7th to Lake Superior, warnings being continued on Lake Michigan in the meantime. Maximum storm winds occurred on the Great Lakes in connection with this disturbance as follows: 6th, Chicago 46 miles an hour from

the northeast: 7th, Alpena 48 southeast, Toledo 42 southwest, Green Bay 46 northeast, Marquette 44 east, Port Huron 36 southeast, Grand Haven 38 south, Escanaba 40 east, Sault Ste. Marie 36 east, Plum Island 46 east; 8th, Duluth 42 northeast. Moreover, during its passage northeastward from the southern Rocky Mountain region to the upper Lakes this disturbance gave rise to numerous thunderstorms and severe local windstorms over the southern Plains States, the lower Mississippi and lower Ohio Valleys, Tennessee, and the east Gulf States, and tornadoes occurred in parts of Missouri, Arkansas, Mississippi, Illinois, Tennessee, and Kentucky. In Arkansas the tornadoes were very destructive: according to press reports about 200 persons were killed or injured and much property was destroyed.

*Chicago District.*—Unsettled weather prevailed with more than the usual frequency over the district during the month, and therefore conditions were not favorable for the formation of frost. The only places where frost occurred were the western portion of Montana and the elevated sections of Wyoming early in the month but no damage was possible. The areas, as a rule, were covered by warnings fairly well in advance of the occurrences. No frost of consequence occurred in the Wisconsin cranberry marshes during the entire month, there being observed but two light frosts—one at Cranmoor on June 5 and one at Berlin on the 21st.

Fire-weather warnings were issued on the 2d for northern Montana for fresh winds by the afternoon of the following day, and the warning was repeated on June 3. No information is at hand as to the verification of these forecasts, but the weather map indicated that they were fully verified.—*H. J. Cox, Professor of Meteorology.*

*Denver District.*—There was a general absence of activity on the part of low pressure areas affecting this district. Some of the low areas remained nearly stationary for days at a time and this feature together with the lack of anticyclonic areas of importance in favorable locations resulted in one of the driest Junes on record in the greater part of the district. At Denver it was next to the driest June on record.

Frost warnings were issued for Colorado, Utah and northern New Mexico on June 2, as an anticyclonic area attended by frost was spreading eastward across the middle Rocky Mountain region. Frost temperatures were recorded in localities in Colorado and Utah on the morning of the 3d. In northern New Mexico, however, the weather became cloudy and somewhat warmer under the influence of a low pressure area that developed in the southern portion of New Mexico.

On the 5th an anticyclonic area over the north Pacific States gave unmistakable indications of moving eastward to the northern Rocky Mountain region and warnings of local frost were issued for Utah. Temperatures fell nearly to 40° in northern Utah on the morning of the 6th, but were above normal in southern Utah under the influence of low pressure that developed in Arizona and New Mexico. Warnings of local frost were issued for Colorado and Utah on the 6th, as the cool anticyclonic area was overspreading the northern Rocky Mountain region as anticipated, and had caused a sharp fall in temperature in the extreme northern portions of Colorado and Utah. Frost temperatures occurred quite generally in Colorado and southern Utah on the morning of June 7. In southwestern Colorado and southern Utah temperatures close to the freezing point were reported. Another threatening anticyclonic area appeared on the north Pacific coast on the 10th and warnings of frost in localities in the extreme northern part of Utah were issued.

A considerable fall in temperature occurred in northern Utah and temperatures close to the freezing point were reported near the Idaho-Utah line.

Fire-weather forecasts were issued for northern Arizona on the 9th and 20th. The following extract from a communication received from the forest supervisor at Williams, Ariz., refers to the warning of the 9th:

You will be interested to learn that your prediction of high winds proved to be correct, for we had quite a gale blowing all of Friday afternoon, the day your wire was received.

At 8 p. m. on the 20th the wind at Flagstaff, Ariz., attained a velocity of 30 miles per hour from the southwest.—*Fredrick W. Brist, Assistant Forecaster.*

*New Orleans District.*—An area of low pressure which was centered over New Mexico on the morning of June 4 had moved southeastward and was centered over the northern portion of western Texas at 8 p. m., and southeast storm warnings were ordered at 8.30 p. m. for the Texas coast. The disturbance moved toward the northeast and gave storm winds at the Texas coast stations. No other disturbance passed over the district during the month and moderate weather conditions with scattered thundershowers prevailed.—*I. M. Cline, District Forecaster.*

*Portland, Oreg., District.*—June, usually a quiet month in this district, was noted this year for its unsettled, showery weather, which characterized nearly every day during the last half of the month. Frost warnings were issued on six occasions for limited areas in eastern Oregon and southern Idaho. Five of these warnings were verified and one was a failure. Frost formed at one or two localities on six mornings without warnings. Most of these frosts were due to the prevalence of unusually low temperatures during unsettled, showery weather, which temporarily cleared just at sunrise.

Warnings for the benefit of the live-stock industry were sent on the morning of June 8. They announced the change to much cooler weather with some rain in the mountains during the next two days. These warnings were fully verified. On the morning of the 10th the same interests were advised that fair weather with cool nights and slowly moderating day temperatures would prevail during the next two days.

On June 30 a small-craft warning was ordered displayed at the mouth of the Columbia River. It was fully verified.

During the afternoon of the 26th severe electrical storms with hail and excessive rain occurred in a number of places in the northeastern part of Oregon. The newspapers called these storms "cloud-bursts," and they stated the damage to crops, buildings, and roads was heavy but no lives were lost. On the 30th a severe storm, also called a "cloudburst" by the newspapers, flooded the "Upper Hay Canyon" in Sherman County, and four persons were drowned in the flood waters.—*E. A. Beals, District Forecaster.*

*San Francisco District.*—Warnings of showers in the extreme northern portion of northern California were issued on the morning of June 29, and an indefinite forecast for showers over that section was issued on the 30th. These appear to have been justified. Northwest storm warnings were ordered at Point Reyes on the 8th, 9th, 19th, and 20th, and in each instance were followed by verifying velocities.

The Forest Service was warned of conditions favorable for forest fires on the 5th, 6th, 7th, 10th, 14th, 15th, 20th, and 21st, in northern California. While the conditions were at no time very intense, the warnings were appreciated.—*G. H. Willson, District Forecaster.*